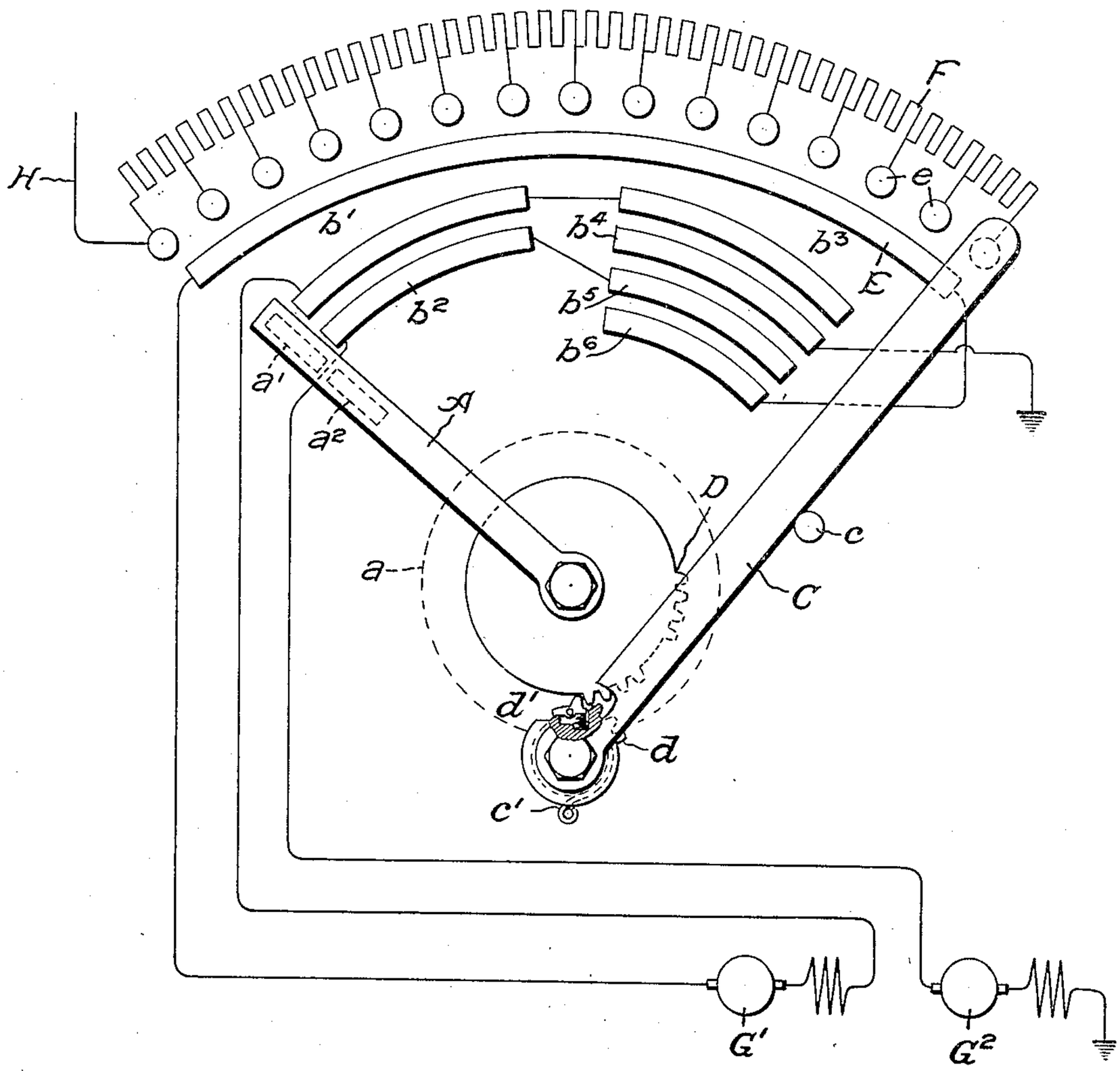
G. H. HILL.

CONTROLLING SWITCH.

APPLICATION FILED OCT. 11, 1906.

912,128. Patented Feb. 9, 1909.



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UNITED STATES PATENT OFFICE.

GEORGE H. HILL, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CONTROLLING-SWITCH.

No. 912,128. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed October 11, 1906. Serial No. 338,339.

To all whom it may concern:

Be it known that I, GEORGE H. HILL, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Controlling-Switches, of which the following is a specification.

My invention relates to electric switches, and is particularly applicable to controlling-switches for electric motors, although not limited to switches employed for this purpose.

One well known method of control for a plurality of electric motors is the series-parallel control, in which the motors are first connected in series with each other with a resistance in circuit, then the resistance is gradually cut out, then the motors are connected in parallel with the resistance again in circuit, and then the resistance is again cut out. It is usually desirable to perform these several operations by means of a single switch, but when the number of resistance steps is large, the number of switch contacts required is great, since the process of cutting out the resistance is performed twice in the movement of the switch.

The object of my invention is to reduce the number of contacts required, and consequently the size of the switch, and consists in providing two switch members, one of which may make the series-parallel or other connections, and the other of which may be arranged to vary the resistance in circuit, and employing connections between the two switch members such that when the first switch member is moved over each set of contacts, the other member is moved over its range and is released upon transition of the first switch member from one set of contacts to another. Thus, by providing the second member with means for returning it automatically to starting position when released, it may be caused to move over its range a number of times during a single movement of the other switch member. In this way the same set of contacts is utilized for cutting the resistance out of circuit in each case, so that the number of contacts required and the size of the switch is reduced.

My invention will best be understood by reference to the accompanying drawing, which shows somewhat diagrammatically a controlling switch arranged in accordance with my invention.

In the drawing, A represents a switch-arm provided with any suitable form of handle indicated by the dotted circle *a*. This arm carries two contacts a^1 and a^2, which move over stationary contacts b^1 to b^6.

C represents a second arm which is normally held in off-position against a stop *c* by the spring c^1. This arm C is actuated by the movement of arm A through connections comprising a mutilated gear D on the arm A and a pinion *d* on the arm C. This pinion is provided with one tooth d^1 arranged so as to resist pressure in one direction, but to yield to pressure in the opposite direction, for reasons that will hereafter appear. The arm C moves over a long contact E and a plurality of contact studs *e* connected to points on the resistance F.

I have shown two motors G^1 and G^2 as the devices controlled by the switch, but it will be understood that the switch construction shown is applicable to the control of other devices.

H represents a conductor leading to a source of current.

The operation is as follows: When the switch-arm A is moved toward the right, the contact a^1 bridges contacts b^1 and b^2, thereby closing a circuit from conductor H through resistance F, arm C, contact E, motor G^1, contacts b^1, a^1 and b^2, and motor G^2 to ground. The motors are thus connected in series with all the resistances in circuit. As the arm A is moved toward the right, the series connection of the motors is maintained, but arm C is moved toward the left, so as to cut resistance F gradually out of circuit. The spring actuated tooth d^1 of the pinion resists the pressure upon it during the movement of the arms in this direction, and acts as though it were rigid. When the arm A reaches the right-hand end of contacts b^1 and b^2, arm C has reached its extreme left-hand position, and all of resistance F is cut out of circuit. Now, if the movement of arm A to the right is continued, so as to break the motor circuit by leaving the contacts b^1 and b^2, the teeth on the mutilated gear D at the same time release the pinion *d*, so that the arm C is returned to starting position by the spring c^1. Consequently, when arm A is brought into engage-

ment with contacts b^3 to b^6, thereby connecting the motors in parallel to the source, all of resistance F is again in circuit. As the movement of arm A is continued toward the right, arm C is again moved toward the left, cutting out the resistance.

The purpose of the spring-actuated tooth d^1 will be seen by considering the return movement of the arm. Suppose arm A has been moved to its extreme right-hand position, thereby carrying arm C to its extreme left-hand position so as to connect the motors in parallel, with all the resistance cut out of circuit: now, if arm A is moved toward the left, arm C will be returned toward the right, and will reach the stop *c* when arm A leaves contacts b^3 to b^6,—that is, arm C and pinion *d* would be in the position shown in the drawing, while arm A would be in a vertical position. Upon attempting to move arm A further to the left, the teeth on the gear D will press upon the left-hand face of the tooth d^1, and if this tooth were rigid the return to off-position of arm A would be prevented, but by mounting the tooth as shown, it yields to the pressure, allowing arm A to be returned to its off-position as shown.

Although I have illustrated and described my invention as applied to the control of series motors with the resistance in the armature circuit, my invention is equally applicable to the control of shunt motors with the resistance in the field circuit, and to other devices than motors. Further, I do not desire to limit myself to the particular construction and arrangement of parts here shown, but aim in the appended claims to cover all modifications which are within the scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a controlling-switch, a pivoted switch member, a plurality of sets of contacts arranged to be engaged thereby, each set extending over a portion of the range of movement of said member, a second pivoted member, a set of contacts arranged to be engaged thereby, and operative connections between said members whereby the second member is moved over its range during the movement of the first member over each set of contacts and is moved in the opposite direction to starting position upon the transition of the first member from one set of contacts to another.

2. In a controlling-switch, a switch member, a plurality of sets of contacts arranged to be engaged thereby, each set extending over a portion of the range of movement of said member, a second member, a set of contacts arranged to be engaged thereby, operative connections between said members adapted to engage and move the second member upon the movement of the first member over each set of contacts and to release the second member upon the transition of the first member from one set of contacts to another, and means for automatically returning the second member to starting position when released.

3. In a controlling-switch, two switch members, a mutilated gear on one member, a pinion on the second member adapted to be engaged by said gear, and means for automatically returning the second member to starting position when released.

4. In a controlling-switch, two switch members, a mutilated gear on one member, a pinion on the second member adapted to be engaged by said gear, means for automatically returning the second member to starting position when released, and means for permitting the return movement of the first member without moving the second member when the second member is in starting position.

5. In combination with an electric circuit and a plurality of devices therein, a controlling-switch for said devices comprising a switch member arranged to vary the relative connections of said devices to each other, a second switch member arranged to vary the amount of resistance in said circuit, a mutilated gear on the first member, a pinion on the second member adapted to be engaged by said gear, and means for automatically returning the second member to off-position when released.

6. In combination with an electric circuit and a plurality of devices therein, a controlling-switch for said devices comprising a switch member arranged to vary the relative connections of said devices to each other, a second switch member arranged to vary the amount of resistance in said circuit, a mutilated gear on the first member, a pinion on the second member adapted to be engaged by said gear, means for automatically returning the second member to off-position when released, and means for permitting the return movement of the first member without moving the second member when the second member is in off-position.

7. In combination with an electric circuit and a plurality of devices therein, a controlling-switch for said devices comprising a switch member and a plurality of sets of contacts coöperating therewith to connect said devices in different relations to each other, each set of contacts extending over a portion of the range of movement of said member, a second switch member and contacts coöperating therewith to vary the amount of resistance in said circuit, operative connections between said members adapted to engage and move the second member upon the movement of the first member over each set of contacts and to release the second member upon the transition of the first member from one set of contacts to another, and means for

automatically returning the second member to starting position when released.

8. In a controlling-switch, two switch members, a mutilated gear on one member, a pinion on the second member adapted to be engaged by said gear, and means for automatically returning the second member to starting position when released, said pinion having a tooth adapted to yield to pressure in one direction and to resist pressure in the opposite direction.

In witness whereof, I have hereunto set my hand this 9th day of October, 1906.

GEORGE H. HILL.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.